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10/537893  
JC09 Rec'd PCT/PTO 07 JUN 2005  
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**International Preliminary  
Examination Authority  
EUROPEAN PATENT OFFICE**  
P.B. 5818 Patentlaan 2  
NL-2280 HV Rijswijk  
Netherlands

Clamart, March 10, 2005

International Patent Application No. **PCT/EP03/12205**  
International Filing Date: 27 October 2003  
Our Ref: **WO 21.1099**

Dear Sirs,

I refer to the written opinion of the International Preliminary Examination Authority dated February 11, 2005.

The Applicant respectfully submits the new set of claims, which is believed to overcome the Examiner's objections as set forth in the February 11 official action. Former claims 6 and 17-18 have been withdrawn from new set of claims. The dependent claims have been reorganized and renumbered in consequence.

Applicants respectfully disagree with examiner's rejection against novelty of claim 7, now renumbered 6 for the same reasons as already exposed in the previous response to official action. Applicant would like to re-emphasize herein that D1 discloses a method for matching a plurality of curves (23A, 25A) obtained from sensors (23-26). To compare 23A and 25A the derivatives of each curve could be compared (line 46); nevertheless "the simple derivative is not suitable because it will give large values even for low amplitude noise" (lines 47-49). That is why, activity functions (23B, 25B) are created corresponding roughly to the curves (23A, 25A) filtered with a high-pass filter. Therefore, this activity function is not an average

signal of a two-dimensional data set as described in our invention and the method described in D1 is completely different of our invention.

It is therefore submitted that the claims are both novel and involve an inventive step and a favourable preliminary examination report is requested.

Yours faithfully,

A handwritten signature in black ink, appearing to read 'Raybaud', enclosed within a simple rectangular box.

Hélène RAYBAUD

European Patent Attorney

Encs.

## CLAIMS

1. A method for matching a plurality of data sets from boreholes or core sections, the data sets being obtained from sensors are two-dimensional data sets and are indicative of earth formation, boundary, or interface of earth formations and of dip in the vicinity of the borehole, the method for depth matching being characterized in that:
  - (a) the two-dimensional data sets are transformed into three-dimensional images using the Hough transform;
  - (b) two dimensional curves are derived from the three-dimensional images by the application of the Hough transform to depth derivatives of sensor signals, generated by sensors; and
  - (c) an offset is derived from the two-dimensional curves for applying to the two dimensional data sets to depth match them to each other.
2. The method in accordance with claim 1 wherein the method is further characterized in that the two dimensional curves have peaks indicating dip events in the vicinity of the borehole.
3. The method in accordance with claim 1 wherein the method is further characterized in that the two-dimensional data sets have gaps in the data and the three-dimensional images created using the-Hough transform are immune from the gaps.
4. The method in accordance with claim 1 wherein the method is further characterized in that two-dimensional curves for data sets from sensors that are vertically spaced from each other longitudinally along the borehole are processed to determine an offset that will match the two-dimensional curves.
5. The method in accordance with claim 4 wherein the method is further characterized in that the determined offset is applied to the data sets from the vertically spaced sensors to depth match the data sets to each other.

6. A method for matching a plurality of data sets from boreholes or core sections, the data sets being obtained from sensors are two-dimensional data sets and are indicative of a boundary, or interface of earth formations and of dip in the vicinity of the borehole, the method for depth matching being characterized in that:

for each two-dimensional data set of the plurality of data sets, individual signals making up the respective two-dimensional data set are combined to create an averaged signal;

averaged signals, each corresponding to one two-dimensional data set, are processed to calculate an offset that correlates the averaged signals; and

the calculated offset is applied to the two-dimensional data sets to depth match them to each other.

7. The method of claim 6 wherein said averaged signal are obtained by determining an average of the sensor signals along the bedding dip for a given depth in the borehole.

8. The method of claim 7 wherein said computation of bedding dips for the sensor signals is performed by way of the Hough transform.

9. The method in accordance with claims 1 or 6 wherein the method is further characterized in that two-dimensional data sets to be depth matched are obtained at the same time by sensors that are vertically spaced from each other longitudinally along the borehole.

10. The method in accordance with claims 1 or 6 wherein the method is further characterized in that two-dimensional data sets to be depth matched are obtained at different times for the same borehole.

11. The method in accordance with claims 1 or 6 wherein the method is further characterized in that a two-dimensional data set to be depth matched is obtained from a core section.

12. The method of claims 1 or 6 wherein each of said sensor signals is obtained from a sensor of a plurality of sensors.

13. The method of claim 12 wherein each sensor includes a plurality of sub sensors.

14. The method of claim 13 wherein each signal includes a trace, the trace being a side-by-side combination of signals from the plurality of sub sensors.

15. The method in accordance with claims 1 or 6 wherein the method is further characterized in that it is applicable to real time depth matching of data sets from sensors that are vertically spaced from each other longitudinally along the borehole.

# PATENT COOPERATION TREATY

From the  
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

## PCT

To:

RAYBAUD, Hélène  
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F-92142 Clamart Cedex  
FRANCE

### WRITTEN OPINION

(PCT Rule 66)

**11 MARS 05**

Date of mailing  
(day/month/year)

11.02.2005

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Applicant's or agent's file reference  
WO 21.1099

**REPLY DUE**

**within 1 month(s)**  
from the above date of mailing

International application No.  
PCT/EP 03/12205

International filing date (day/month/year)  
27.10.2003

Priority date (day/month/year)  
13.12.2002

International Patent Classification (IPC) or both national classification and IPC  
G01V3/20

Applicant  
SERVICES PETROLIERS SCHLUMBERGER

1. This written opinion is the **second** drawn up by this International Preliminary Examining Authority.
2. This opinion contains indications relating to the following items:
  - I ☒ Basis of the opinion
  - II ☐ Priority
  - III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
  - IV ☐ Lack of unity of invention
  - V ☒ Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
  - VI ☐ Certain documents cited
  - VII ☐ Certain defects in the international application
  - VIII ☐ Certain observations on the international application
3. The applicant is hereby **invited to reply** to this opinion.
 

**When?** See the time limit indicated above. The applicant may, before the expiration of that time limit, request this Authority to grant an extension, see Rule 66.2(d).

**How?** By submitting a written reply, accompanied, where appropriate, by amendments, according to Rule 66.3. For the form and the language of the amendments, see Rules 66.8 and 66.9.

**Also:** For an additional opportunity to submit amendments, see Rule 66.4.  
For the examiner's obligation to consider amendments and/or arguments, see Rule 66.4 bis.  
For an informal communication with the examiner, see Rule 66.6.

**If no reply is filed**, the international preliminary examination report will be established on the basis of this opinion.
4. The final date by which the international preliminary examination report must be established according to Rule 69.2 is: 13.04.2005

Name and mailing address of the international preliminary examining authority:



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Authorized Officer

Häusser, T

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**I. Basis of the opinion**

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this opinion as "originally filed"*):

**Description, Pages**

1-22 as originally filed

**Claims, Numbers**

1-18 received on 21.12.2004 with letter of 20.12.2004

**Drawings, Sheets**

1/8-8/8 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).  
☐ the language of publication of the international application (under Rule 48.3(b)).  
☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.  
☐ filed together with the international application in computer readable form.  
☐ furnished subsequently to this Authority in written form.  
☐ furnished subsequently to this Authority in computer readable form.  
☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.  
☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:  
☐ the claims, Nos.:  
☐ the drawings, sheets:

5. ☐ This opinion has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)).

6. Additional observations, if necessary:

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**V. Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement****1. Statement**

Novelty (N)	Claims	6, 7, 17, 18
Inventive step (IS)	Claims	10-12, 16
Industrial applicability (IA)	Claims	

**2. Citations and explanations****see separate sheet**

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**WRITTEN OPINION  
SEPARATE SHEET**

International application No. PCT/EP 03/12205

**Re Item V**

**1 Reference is made to the following documents:**

- D1: US-A-4 517 835 (KERZNER MARK G) 21 May 1985 (1985-05-21)  
D2: SZENDRO D: "Automatic relative depth matching of borehole information. I. Theoretical review" GEOPHYSICAL TRANSACTIONS, vol. 32, no. 4, April 1987 (1987-04), pages 333-353, XP008019187

**2 The present application does not meet the criteria of Article 33(1) PCT, because the subject-matter of claims 6, 7, and 17 is not new in the sense of Article 33(2) PCT.**

2.1 The document D1 discloses (the references in parentheses applying to this document) the matching of a plurality of data sets (23A, 24A, 25A, 26A) being obtained from sensors (23-26). The data-sets are two-dimensional (being a function of depth and azimuth, see column 6, line 56 to column 7, line 3 and figure 1) and are indicative of dip in the vicinity of the borehole (column 8, lines 12-16). For each data set individual signals are combined to create an averaged signal (23B, 25B) (column 8, lines 50-66). An offset is calculated and the curves are depth matched (column 11, lines 30-64).

The subject-matter of claim 7 is therefore not new.

2.2 The document D1 discloses (the references in parentheses applying to this document) a well logging tool comprising a plurality of sensors (23-26), a processor (29), and storage means (34) coupled therewith (column 5, lines 9-11), the plurality of sensors (23-26) adapted to generate data sets indicative of dip in the vicinity of the borehole (column 8, lines 12-16). The mere reference in the device claims 6 and 17 to method claims 1 and 7, respectively, does not imply the presence of any further device features in claims 6 and 17.

The subject-matter of claims 6 and 17 is therefore not new.

**3 Dependent claims 10-12 and 16 when dependent on claim 7, and dependent claim 18 do not contain any features which, in combination with features of the respective independent claims, meet the requirements of the PCT in respect of**

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**WRITTEN OPINION  
SEPARATE SHEET**

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International application No. PCT/EP 03/12205

**novelty and/or inventive step, see documents D1 and D2 and the corresponding passages cited in the search report.**

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